

WHAT IS CLAIMED:

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1. A DNA construct comprising:
a fusion gene comprising
a trait DNA molecule which has a length
that is insufficient to impart a desired trait to plants
transformed with said trait DNA molecule and
a silencer DNA molecule operatively
coupled to said trait DNA molecule, wherein said trait
10 DNA molecule and said silencer DNA molecule collectively
impart the trait to plants transformed with said DNA
construct.
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2. A DNA construct according to claim 1,
wherein said DNA construct comprises a plurality of trait
DNA molecules each having a length that is insufficient
to impart that trait to plants transformed with that
trait DNA molecule.
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3. A DNA construct according to claim 2,
wherein the trait DNA is a viral cDNA molecule and the
trait is viral disease resistance.
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4. A DNA construct according to claim 3,
wherein said viral cDNA molecules are selected from the
group consisting of a DNA molecule encoding a coat
protein, a DNA molecule encoding replicase, a DNA
molecule not encoding a protein, a DNA molecule encoding
a viral gene product, and combinations thereof.
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5. A DNA construct according to claim 3,
wherein said viral cDNA molecule is from a plant virus
selected from the group consisting of tomato spotted wilt
virus, impatiens necrotic spot virus, groundnut ringspot
35 virus, potato virus Y, potato virus X, tobacco mosaic
virus, turnip mosaic virus, tobacco etch virus, papaya

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ringspot virus, tomato mottle virus, tomato yellow leaf curl virus, and combinations thereof.

5 6. A DNA construct according to claim 2, wherein the trait DNA is a plant DNA molecule and the trait is a plant genetic trait.

10 7. A DNA construct according to claim 6, wherein the plant DNA molecule effects plant characteristics selected from the group consisting of color, enzyme production, and combinations thereof.

15 8. A DNA construct according to claim 2 further comprising:
a promoter sequence operatively coupled to said fusion gene and
a termination sequence operatively coupled to said fusion gene to end transcription.

20 9. A DNA construct according to claim 2, wherein said silencer DNA molecule is selected from the group consisting of a viral cDNA molecule, a jellyfish green fluorescence protein encoding DNA molecule, a plant DNA molecule, a viral gene silencer, and combinations
25 thereof.

30 10. A DNA construct according to claim 1, wherein the trait DNA is a viral cDNA molecule and the trait is viral disease resistance.

11. A DNA construct according to claim 10, wherein said viral cDNA molecule is selected from the group consisting of a DNA molecule encoding a coat protein, a DNA molecule encoding a replicase, a DNA

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molecule not encoding a protein, a DNA molecule encoding a viral gene product, and combinations thereof.

5 12. A DNA construct according to claim 10, wherein said viral cDNA molecule is from a plant virus selected from the group consisting of tomato spotted wilt virus, impatiens necrotic spot virus, groundnut ringspot virus, potato virus Y, potato virus X, tobacco mosaic virus, turnip mosaic virus, tobacco etch virus, papaya
10 ringspot virus, a DNA molecule not encoding a protein, tomato mottle virus, tomato yellow leaf curl virus, and combinations thereof.

15 13. A DNA construct according to claim 1, wherein the trait DNA is a plant DNA molecule and the trait is a plant genetic trait.

20 14. A DNA construct according to claim 13, wherein the plant DNA molecule effects plant characteristics selected from the group consisting of color, enzyme production, and combinations thereof.

25 15. A DNA construct according to claim 1 further comprising:
a promoter sequence operatively coupled to said fusion gene and
a termination sequence operatively coupled to said fusion gene to end transcription.

30 16. A DNA construct according to claim 1, wherein said silencer DNA molecule is selected from the group consisting of a viral cDNA molecule, a jellyfish green fluorescence protein encoding DNA molecule, a plant DNA molecule, and combinations thereof.

17. A DNA construct according to claim 1, wherein said trait DNA molecule and said silencer DNA molecule encode RNA molecules which are translatable.

5 18. A DNA construct according to claim 1, wherein said trait DNA molecule and said silencer DNA molecule encode RNA molecules which are nontranslatable.

10 19. A DNA construct according to claim 2, wherein one of the trait DNA molecules is long enough to impart the trait.

15 20. A DNA construct according to claim 1, wherein said construct effects post-transcriptional gene silencing within plants.

20 21. A DNA construct according to claim 1, wherein the trait DNA and silencer DNA molecules do not interact with one another.

22. A DNA construct according to claim 1, wherein the silencer DNA molecule is positioned 3' to the trait DNA molecule.

25 23. A DNA expression vector comprising the DNA construct of claim 1.

30 24. A DNA expression vector according to claim 23, wherein said DNA construct comprises a plurality of trait DNA molecules each having a length that is insufficient to impart the trait to plants transformed with that trait DNA molecule.

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25. A DNA expression vector according to claim 24, wherein the trait DNA is viral cDNA and the trait is viral disease resistance.

5 26. A DNA expression vector according to claim 24, wherein the trait DNA is a plant DNA molecule and the trait is a plant genetic trait.

10 27. A host cell transformed with the DNA construct of claim 1.

15 28. A host cell according to claim 26, wherein said DNA construct comprises a plurality of trait DNA molecules each having a length that is insufficient to impart the trait to plants transformed that trait DNA molecule.

20 29. A host cell according to claim 28, wherein said DNA construct is within an expression vector.

30 30. A host cell according to claim 28, wherein said host cell is bacterial.

25 31. A host cell according to claim 28, wherein said host cell is a plant cell.

32. A transgenic plant transformed with the DNA construct according to claim 1.

30 33. A transgenic plant according to claim 32, wherein said DNA construct comprises a plurality of trait DNA molecules each having a length that is insufficient to impart the trait to plants transformed that trait DNA molecule.

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34. A transgenic plant according to claim 33, wherein the trait DNA molecule is a plant viral cDNA molecule and the trait is viral disease resistance.

5 35. A transgenic plant according to claim 34, wherein said viral cDNA molecules are selected from the group consisting of a DNA molecule encoding a coat protein, a DNA molecule encoding a replicase, a DNA molecule not encoding a protein, a DNA molecule encoding a viral gene product, and combinations thereof.

10 36. A transgenic plant according to claim 34, wherein said plant viral cDNA molecule is from a virus selected from the group consisting of tomato spotted wilt virus, impatiens necrotic spot virus, groundnut ringspot virus, potato virus Y, potato virus X, tobacco mosaic virus, turnip mosaic virus, tobacco etch virus, papaya ringspot virus, a DNA molecule not encoding a protein, tomato mottle virus, tomato yellow leaf curl virus, and combinations thereof.

15 37. A transgenic plant according to claim 33, wherein the trait DNA is a plant DNA molecule and the trait is a plant genetic trait.

25 38. A transgenic plant according to claim 37, wherein the plant DNA molecule effects plant characteristics selected from the group consisting of color, enzyme production, and combinations thereof.

30 39. A transgenic plant according to claim 33 further comprising:

a promoter sequence operatively coupled to said fusion gene and

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a termination sequence operatively coupled to said fusion gene to end transcription.

5 40. A transgenic plant according to claim 33, wherein said silencer DNA molecule is selected from the group consisting of a viral cDNA molecule, a jellyfish green fluorescence protein encoding DNA molecule, a plant DNA molecule, and combinations thereof.

10 41. A transgenic plant according to claim 33, wherein said trait DNA molecule and said silencer DNA molecule encode RNA molecules which are translatable.

15 42. A transgenic plant according to claim 33, wherein said trait DNA molecule and said silencer DNA molecule encode RNA molecules which are nontranslatable.

20 43. A transgenic plant according to claim 33, wherein the plant is selected from the group consisting of alfalfa, rice, wheat, barley, rye, cotton, sunflower, peanut, corn, potato, sweet potato, bean, pea, chicory, lettuce, endive, cabbage, brussel sprout, beet, parsnip, turnip, cauliflower, broccoli, radish, spinach, onion, garlic, eggplant, pepper, celery, carrot, squash,
25 pumpkin, zucchini, cucumber, apple, pear, melon, citrus, strawberry, grape, raspberry, pineapple, soybean, tobacco, tomato, sorghum, papaya, sugarcane, *Arabidopsis thaliana*, *Saintpaulia*, petunia, pelargonium, poinsettia, chrysanthemum, carnation, and zinnia.

30 44. A transgenic plant according to claim 32, wherein the silencer DNA molecule is heterologous to the plant.

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45. A transgenic plant according to claim 32, wherein the trait DNA molecule is heterologous to the plant.

5 46. A method of imparting a trait to plants comprising:

 transforming a plant with a DNA construct according to claim 1.

10 47. A method according to claim 46, wherein said DNA construct comprises a plurality of trait DNA molecules each having a length that is insufficient to impart the trait to plants transformed with that trait DNA molecule.

15 48. A method according to claim 47, wherein the trait DNA molecule is a plant viral cDNA molecule and the trait is a viral disease resistance.

20 49. A method according to claim 48, wherein said viral cDNA molecule is selected from the group consisting of a DNA molecule encoding a coat protein, a DNA molecule encoding a replicase, a DNA molecule not encoding a protein, a DNA molecule encoding a viral gene product, and combinations thereof.

25 50. A method according to claim 48, wherein said plant viral DNA molecule is from a virus selected from the group consisting of tomato spotted wilt virus, 30 impatiens necrotic spot virus, groundnut ringspot virus, potato virus Y, potato virus X, tobacco mosaic virus, turnip mosaic virus, tobacco etch virus, papaya ringspot virus, a DNA molecule not encoding a protein, tomato mottle virus, tomato yellow leaf curl virus, and 35 combinations thereof.

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51. A method according to claim 47, wherein the DNA molecule is a plant DNA molecule and the trait is a plant genetic trait.

5 52. A method according to claim 51, wherein the plant DNA molecule is for a plant selected from the group consisting of alfalfa, rice, wheat, barley, rye, cotton, sunflower, peanut, corn, potato, sweet potato, bean, pea, chicory, lettuce, endive, cabbage, brussel
10 sprout, beet, parsnip, turnip, cauliflower, broccoli, radish, spinach, onion, garlic, eggplant, pepper, celery, carrot, squash, pumpkin, zucchini, cucumber, apple, pear, melon, citrus, strawberry, grape, raspberry, pineapple, soybean, tobacco, tomato, sorghum, papaya, sugarcane,
15 *Arabidopsis thaliana*, *Saintpaulia*, petunia, pelargonium, poinsettia, chrysanthemum, carnation, and zinnia.

20 53. A method according to claim 47, wherein said silencer DNA molecule is selected from the group consisting of a viral cDNA molecule, a jellyfish green fluorescence protein encoding DNA molecule, a plant DNA molecule, and combinations thereof.

25 54. A method according to claim 47, wherein said trait DNA molecule and said silencer DNA molecule encode RNA molecules which are translatable.

30 55. A method according to claim 47, wherein said trait DNA molecule and said silencer DNA molecule encode RNA molecules which are nontranslatable.

35 56. A method according to claim 47, wherein the plant is selected from the group consisting of alfalfa, rice, wheat, barley, rye, cotton, sunflower, peanut, corn, potato, sweet potato, bean, pea, chicory,

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lettuce, endive, cabbage, brussel sprout, beet, parsnip, turnip, cauliflower, broccoli, turnip, radish, spinach, onion, garlic, eggplant, pepper, celery, carrot, squash, pumpkin, zucchini, cucumber, apple, pear, melon, citrus, strawberry, grape, raspberry, pineapple, soybean, tobacco, tomato, sorghum, papaya, sugarcane, *Arabidopsis thaliana*, *Saintpaulia*, petunia, pelargonium, poinsettia, chrysanthemum, carnation, and zinnia.

10 57. A method according to claim 47 further comprising:
 propagating progeny of the transgenic plants.

15 58. A transgenic plant seed transformed with the DNA construct according to claim 1.

 59. A transgenic plant seed according to claim 20 58, wherein said DNA construct comprises a plurality of trait DNA molecules each having a length that is insufficient to impart that trait to plants transformed with that trait DNA molecule.

 60. A transgenic plant seed according to claim 25 59, wherein the trait DNA molecule is a viral cDNA molecule and the trait is viral disease resistance.

 61. A transgenic plant seed according to claim 30 60, wherein said viral cDNA molecule is selected from the group consisting of a DNA molecule encoding a coat protein, a DNA encoding a replicase, a DNA molecule which does not encode a protein, a DNA encoding a viral gene product, and combinations thereof.

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62. A transgenic plant seed according to claim 60, wherein said viral cDNA molecule is from a virus selected from the group consisting of tomato spotted wilt virus, impatiens necrotic spot virus, 5 groundnut ringspot virus, potato virus Y, potato virus X, tobacco mosaic virus, turnip mosaic virus, tobacco etch virus, papaya ringspot virus, tomato mottle virus, tomato yellow leaf curl virus, and combinations thereof.

10 63. A transgenic plant seed according to claim 59, wherein the trait DNA molecule is a plant DNA molecule and the trait is a plant genetic trait.

15 64. A transgenic plant seed according to claim 63, wherein the plant DNA molecule effects plant characteristics selected from the group consisting of color, enzyme production, and combinations thereof.

20 65. A transgenic plant seed according to claim 59 further comprising:
a promoter sequence operatively coupled to said fusion gene and
a termination sequence operatively coupled to said fusion gene to end transcription.

25 66. A transgenic plant seed according to claim 59, wherein said silencer DNA molecule is selected from the group consisting of a viral cDNA molecule, a jellyfish green fluorescence protein encoding DNA 30 molecule, and combinations thereof.

35 67. A transgenic plant seed according to claim 60, wherein said viral cDNA molecule and said silencer DNA molecule encode RNA molecules which are translatable.

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68. A transgenic plant seed according to claim 60, wherein said viral cDNA molecule and said silencer DNA molecule encode RNA molecules which are nontranslatable.

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69. A transgenic plant seed according to claim 59, wherein the plant seed is for a plant selected from the group consisting of alfalfa, rice, wheat, barley, rye, cotton, sunflower, peanut, corn, potato, sweet potato, bean, pea, chicory, lettuce, endive, cabbage, brussel sprout, beet, parsnip, turnip, cauliflower, broccoli, radish, spinach, onion, garlic, eggplant, pepper, celery, carrot, squash, pumpkin, zucchini, cucumber, apple, pear, melon, citrus, strawberry, grape, raspberry, pineapple, soybean, tobacco, tomato, sorghum, papaya, sugarcane, *Arabidopsis thaliana*, *Saintpaulia*, petunia, pelargonium, poinsettia, chrysanthemum, carnation, and zinnia.

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70. A method of imparting a trait to plants comprising:

planting a transgenic plant seed according to claim 58 and

propagating a plant from the planted transgenic plant seed.

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71. A method according to claim 70, wherein said DNA construct comprises a plurality of trait DNA molecules each having a length that is insufficient to impart that trait to plants transformed with that trait DNA molecule.

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72. A method according to claim 71, wherein the trait DNA molecule is a viral cDNA molecule and the trait is a viral disease resistance.

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73. A method according to claim 72, wherein said viral cDNA molecule is selected from the group consisting of a DNA molecule encoding a coat protein, a DNA molecule encoding a replicase, a DNA molecule which does not encode a protein, a DNA molecule encoding a viral gene product, and combinations thereof.

74. A method according to claim 72, wherein said viral cDNA molecule is from a virus selected from the group consisting of tomato spotted wilt virus, impatiens necrotic spot virus, groundnut ringspot virus, potato virus Y, potato virus X, tobacco mosaic virus, turnip mosaic virus, tobacco etch virus, papaya ringspot virus, tomato mottle virus, tomato yellow leaf curl virus, and combinations thereof.

75. A method according to claim 71, wherein the DNA molecule is a plant DNA molecule and the trait is a plant genetic trait.

76. A method according to claim 75, wherein the plant DNA molecule effects plant characteristics selected from the group consisting of color, enzyme production, and combinations thereof.

77. A method according to claim 71, wherein said silencer DNA molecule is selected from the group consisting of a viral cDNA molecule, a jellyfish green fluorescence protein encoding DNA molecule, a plant DNA molecule, and combinations thereof.

78. A method according to claim 71, wherein said trait DNA molecule and said silencer DNA molecule encode RNA molecules which are translatable.

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79. A method according to claim 71, wherein said trait DNA molecule and said silencer DNA molecule encode RNA molecules which are nontranslatable.

5 80. A method according to claim 71, wherein the plant seed is for a plant selected from the group consisting of alfalfa, rice, wheat, barley, rye, cotton, sunflower, peanut, corn, potato, sweet potato, bean, pea, chicory, lettuce, endive, cabbage, brussel sprout, beet,
10 parsnip, turnip, cauliflower, broccoli, radish, spinach, onion, garlic, eggplant, pepper, celery, carrot, squash, pumpkin, zucchini, cucumber, apple, pear, melon, citrus, strawberry, grape, raspberry, pineapple, soybean, tobacco, tomato, sorghum, papaya, sugarcane, *Arabidopsis thaliana*, *Saintpaulia*, petunia, pelargonium, poinsettia,
15 chrysanthemum, carnation, and zinnia.

81. A method according to claim 71 further comprising:
20 propagating progeny of the transgenic plants.

82. A DNA construct comprising:
a fusion gene comprising:
25 a plurality of trait DNA molecules at least some of which having a length that is insufficient to impart that trait to plants transformed with that trait DNA molecule but said plurality of trait DNA molecules collectively impart their traits to plants
30 transformed with said DNA construct and to effect silencing of the fusion gene.

83. A DNA construct according to claim 82, wherein the trait DNA is a viral cDNA molecule and the
35 trait is viral disease resistance.

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91. A transgenic plant seed transformed with the DNA construct of claim 82.

5 92. A method of imparting a trait to plants comprising:

planting a transgenic plant seed according to claim 91 and propagating a plant from the planted transgenic plant seed.

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